THE WEATHER AND CIRCULATION OF NOVEMBER 1950[1]

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The Indian summer weather which prevailed over most of the country in October 1950 terminated abruptly early in November. The weather of November was spectacular in contrast to the more placid regime of the previous month. Both high and low daily temperature records were set in many localities; heavy rains caused widespread flooding and property damage in the Central Valley of California; and intense storminess caused snow depths to reach record proportions and paralyzed transportation facilities in the upper Ohio Valley.

The mean atmospheric circulation for the month in the vicinity of North America at the 700-mb. level (fig. 1) was characterized by a Gulf of Alaska Low with a trough and below normal heights extending southwestward to the Hawaiian Islands. A ridge was located over the western United States with 700-mb. heights higher than normal in the south but below normal in the north. A full latitude trough extending from northern Canada to Florida had its greatest intensity in the United States and was weaker than normal in Canada. A strong ridge with blocking characteristics was located east of Newfoundland in the western Atlantic.

[1] See Charts I–XI following p. 209, for analyzed climatological data for the month.

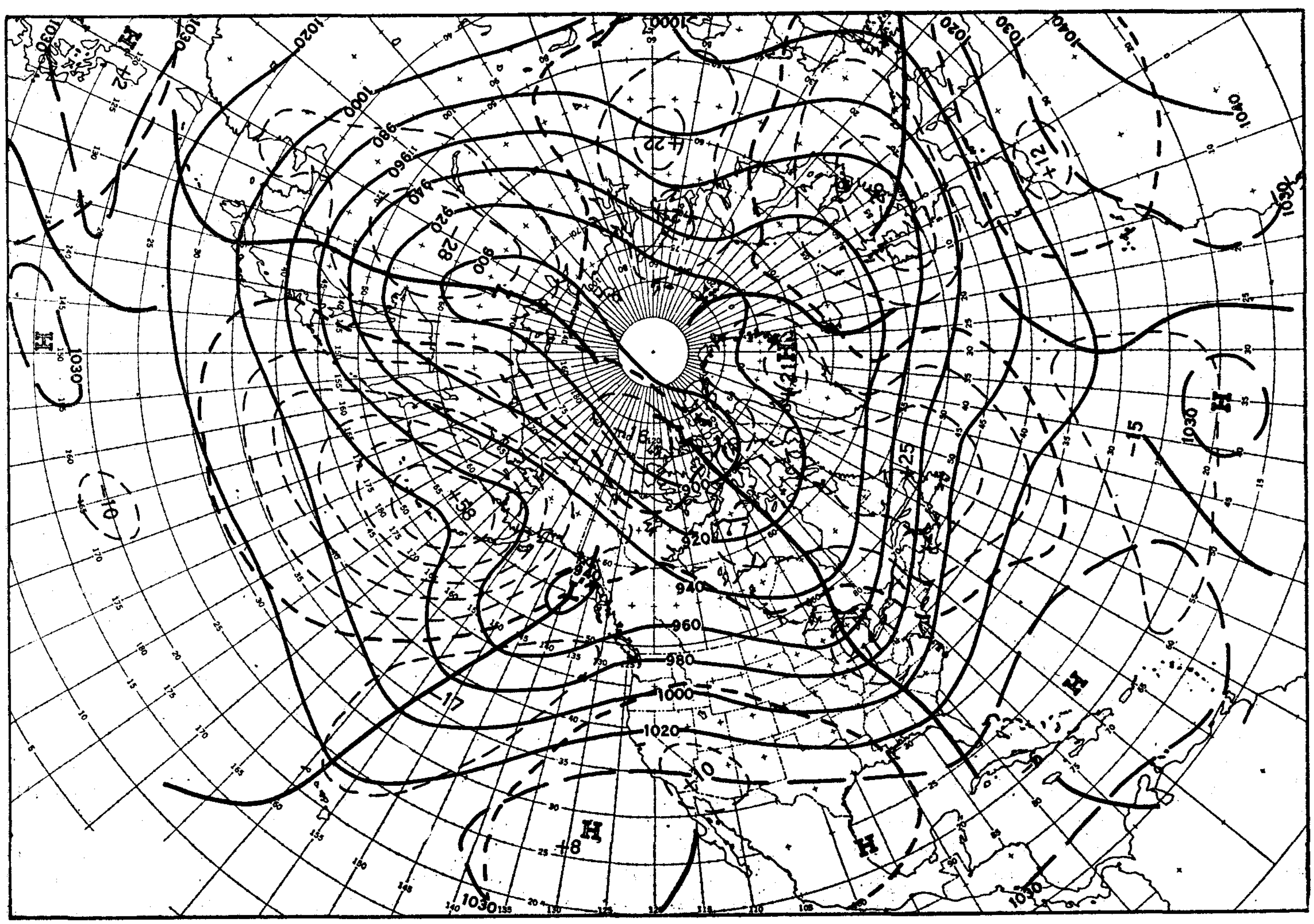


FIGURE 1.—Mean 700-mb. chart for the 30-day period October 31–November 29, 1950. Contours at 200-ft. intervals are shown by solid lines, 700-mb. height departures from normal at 100-ft. intervals by dashed lines with the zero isopleth heavier. Anomaly centers and contours are labeled in tens of feet. Minimum latitude trough locations are shown by heavy solid lines.

Other significant features of the mean atmospheric circulation are apparent from the average geostrophic wind field at the 700-mb. level (fig. 2). A well defined jet stream was located over the United States and the eastern Pacific. The wave pattern which was discussed with the aid of the 700-mb. height field is similarly apparent in the meanders of this jet. A secondary mean jet stream was located over northern Alaska and Canada.

The great contrast in the temperatures observed in different regions of the United States during the month can be seen from Chart I. Much above normal temperatures were recorded in the Northeast and Southwest while very cold weather occurred from the Northern Plains to Florida.

The warm weather in the Southwest was associated with the strong trough in the eastern Pacific. At the 700-mb. level (fig. 1), the mean trajectory of air came from the tropics. The above-normal 700-mb. heights were also associated with the warm temperatures.

The low temperatures observed from the Northern Plains to Florida may also be interpreted with the aid of the 700-mb. circulation. The belt of maximum below-normal temperatures was found where the sum of the contributions from the below-normal heights and the stronger-than-normal northwesterly flow was greatest. It is believed, however, that the temperatures in this region would not have been as cold as observed if it had not been for the persistent generation of unusually cold polar continental Highs in northwestern Canada and Alaska. The monthly mean sea level pressure for this area (not shown) shows a well defined mean anticyclone centered on the Alaskan-Canadian border with central pressure 15 mb. above normal. The anticyclone tracks, Chart II, show that several of the polar Highs which entered the Northern Plains originated in this region. It is interesting to note that the main anticyclone track approximately followed the direction of mean flow at the 700-mb. level except where this track crossed the main jet stream in the Great Plains (see figs. 1 and 2). The greatest angle between this track and the mean 700-mb. flow was found in the region of strong cyclonic shear north of the jet stream. The track again approximated the mean flow aloft in the region of anticyclonic shear south of the jet in the Southeast.

The negative sea level pressure anomaly center located over the Great Lakes (Inset Chart II) reflected the marked deepening of daily cyclones as they entered this region. These deep cyclones, whose tracks are shown on Chart III, were accompanied by rapid transport of cold air from Canada into the southeastern United States. Zero-degree weather which was observed as far south as Georgia caused considerable property and crop damage.

The greatest above-normal temperatures observed in the Northeast occurred in the region where the sum of the contributions from the above-normal heights and the strong relative-to-normal southeasterly flow at the 700-mb. level was greatest. At sea level, a stronger-than-normal southeasterly flow was observed. In November, the ocean temperatures along the east coast are considerably warmer than the normal temperatures over the land so that a stronger-than-normal flow from the ocean to the land will cause temperatures to be predominately above normal. New record-high November temperatures were set during this month in New England.

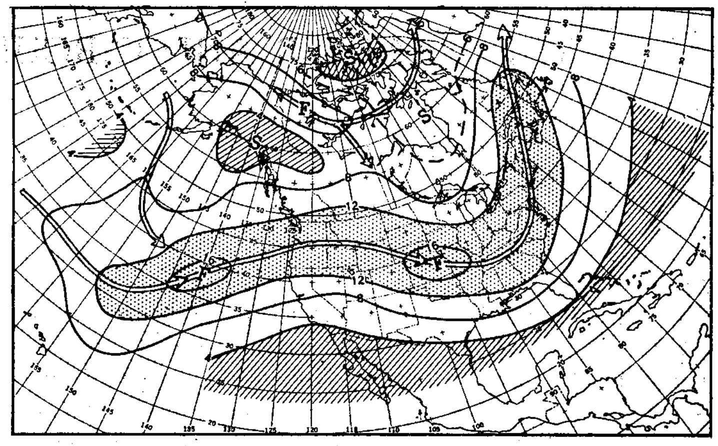


FIGURE 2.—Mean geostrophic (total horizontal) wind speed at 700 mb. for the 30-day period October 31–November 29, 1950. Isotachs at 4-m. p. s. intervals are shown by solid lines while the axes of maximum wind speeds (jets) are shown by double lines.

Consider now the monthly precipitation anomaly (Inset Chart V) and its relation to the average circulation of the month. The predominance of heavy precipitation in the West can be ascribed to the strong southwesterly flow from the deep trough extending into the tropics in the vicinity of the Hawaiian Islands (see fig. 1). This permitted considerable amounts of moisture to be transported northward into the main belt of westerlies. The stronger-than-normal flow of air entering the continent from the Pacific was associated with stronger-than-normal orographic lifting. The general flooding which took place in the Central Valley of California and caused considerable damage to crops and property was due to this heavy precipitation and also to extensive melting of the existing snowpack in the mountains. It can be seen from the cyclone tracks (Chart III) that little of the precipitation recorded in the Southwest was due to the proximity of cyclone paths. It is interesting that what little cyclonic activity took place along the mean 700-mb. ridge in western North America occurred in the region of strong cyclonic shear north of the mean 700-mb. jet stream (see fig. 2).

The central portion of the country from the Continental Divide to the Mississippi River was generally deficient in precipitation. This was due mainly to the rainshadow effect caused by the fast westerlies depositing most of their moisture on the western slopes of the Divide and descending the eastern slopes with little moisture. In the southern part of this region there was little cyclonic activity and a pronounced anticyclonic shear aloft. This was associated with drought conditions in Texas and New Mexico where many stations recorded little or no precipitation for the entire month and supplemental feeding was required for cattle. In the Northern Plains generally normal amounts of precipitation were recorded mainly in the form of snow (see Chart VII). Here the effect of the downslope flow was counteracted by the proximity of the storm track, the strong cyclonic shear aloft, and the easterly wind components at sea level relative to normal (Chart III inset).

Precipitation was deficient in the Southeast. It appears that little moist tropical air entered this region, because of the northerly flow relative to normal at the 700-mb. level (see fig. 1) and the slight reverse tilt to the trough (NNW-SSE).

The Ohio Valley and the Northeast generally received excessive amounts of precipitation much of which was in the form of snow (see Chart VII). Snow depths in western Pennsylvania, eastern Ohio, and West Virginia reached record proportions (1 to 3 feet) blocking highways and paralyzing city transportation. A deep 700-mb. mean trough with considerable trough-ridge amplitude was located in the western portion of this area and a negative pressure anomaly center was observed both at sea level (Inset Chart II) and aloft (fig. 1). Considerable mean cyclonic vorticity is apparent in the flow in this region, as can be seen from the curvature of the sea level isobars (Chart VI), and 700-mb. contours (fig. 1) as well as the horizontal wind shear shown in figure 2.

The direction of cyclone tracks for the month over eastern North America (Chart III) might at first glance appear chaotic. Once one realizes that the ridge east of Newfoundland had strong blocking characteristics at the end of the month, however, a regular transition in the direction of the cyclone paths becomes apparent. At the beginning of the month, cyclones traversed eastern North America moving toward the east and northeast. The latter half of the month, when blocking was active, cyclones traveled toward the north and even northwest, causing new snowfall records in the upper Ohio Valley and winds of hurricane velocity (gusts to over 100 m. p. h.) in the Northeast. (See article by Smith on the following pages.)

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, November 1950

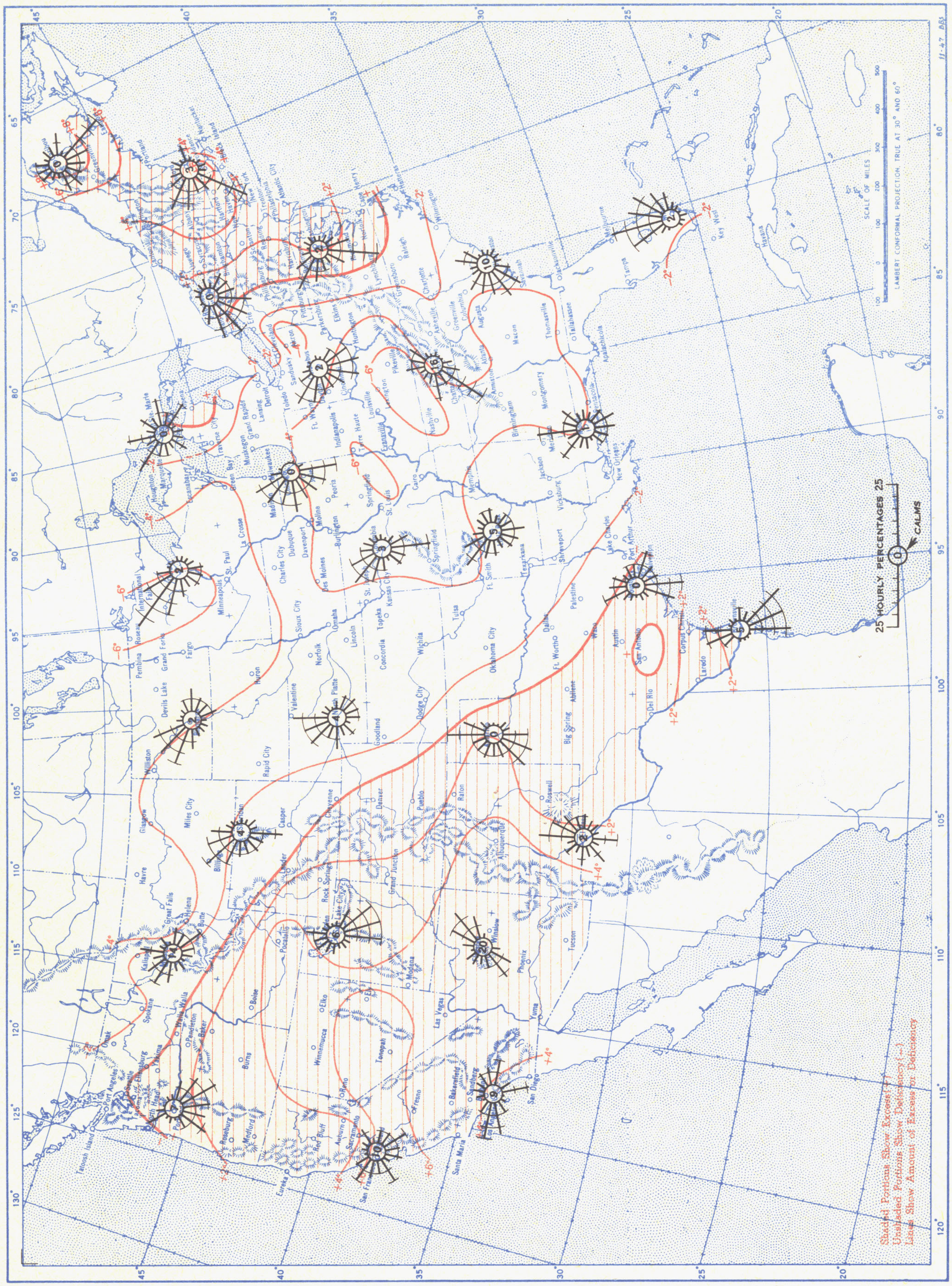
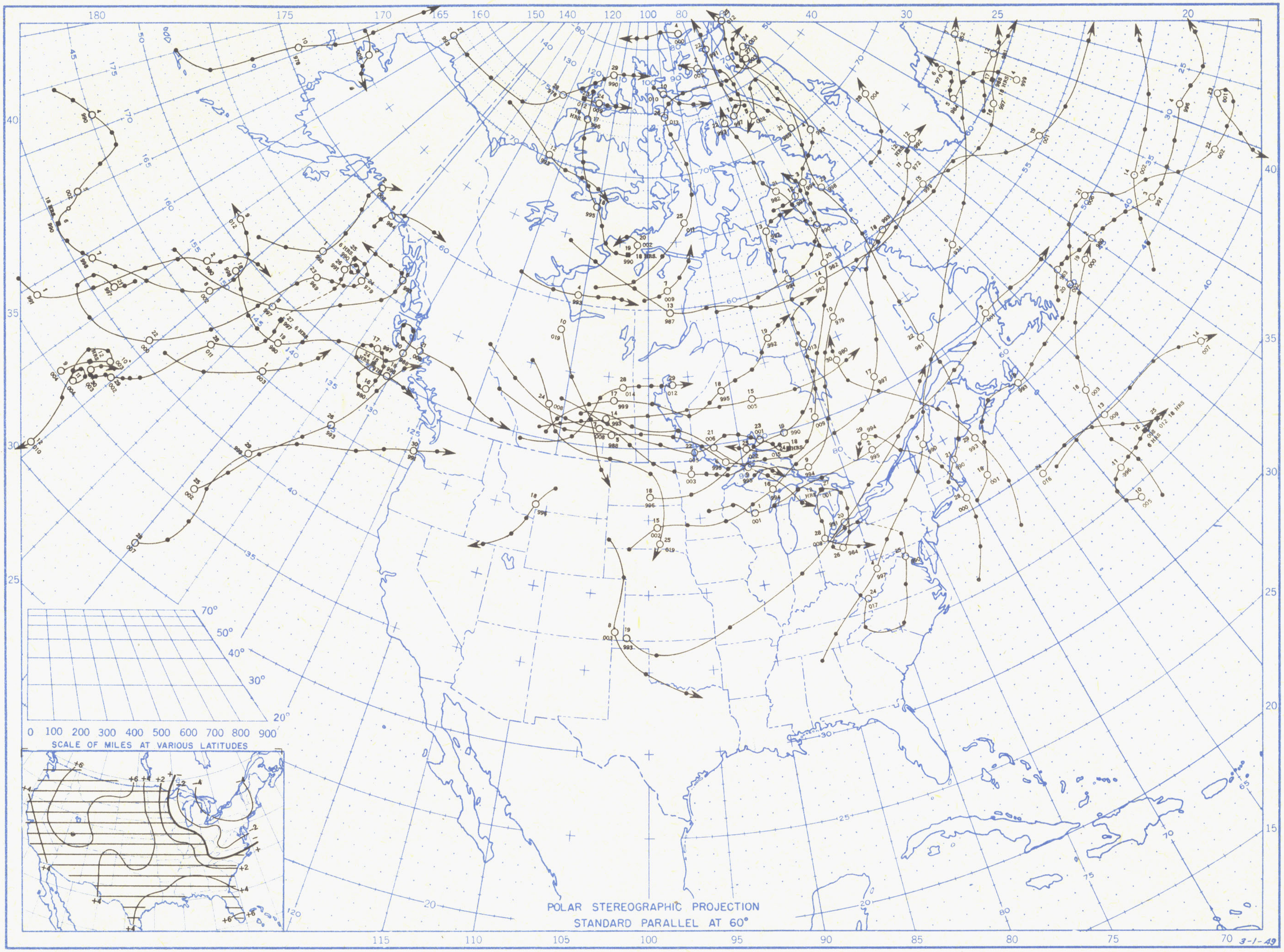


Chart II. Tracks of Centers of Anticyclones, November 1950. (Inset) Departure of Monthly Mean Pressure from Normal

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Figure above circle indicates date, and figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Square indicates position of stationary center for period shown. Only those centers which could be identified for 24 hours or more are included.

Chart III. Tracks of Centers of Cyclones, November 1950. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time). Figure above circle indicates date, and figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Square indicates position of stationary center for period shown. Only those centers which could be identified for 24 hours or more are included.

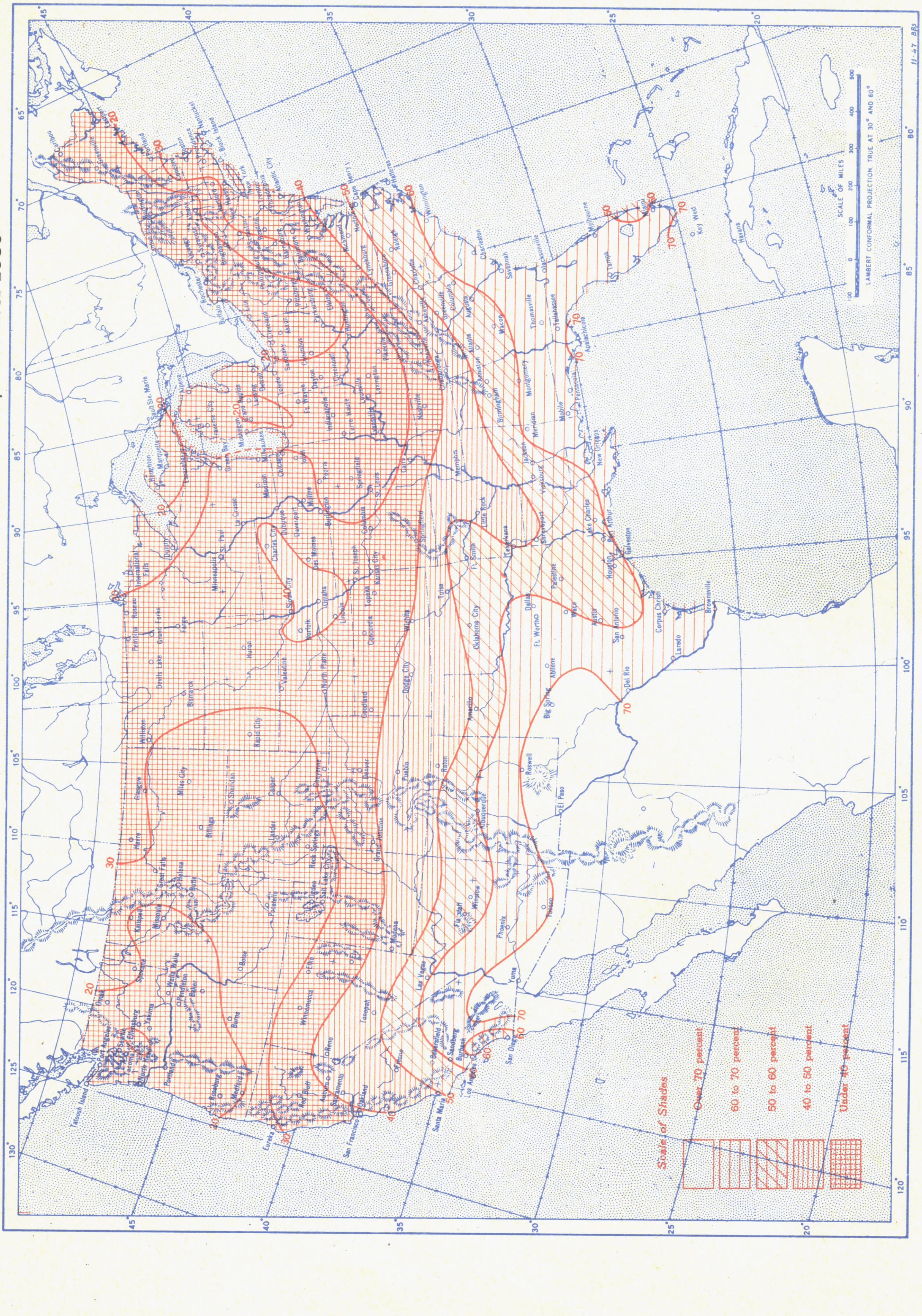


Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, November 1950

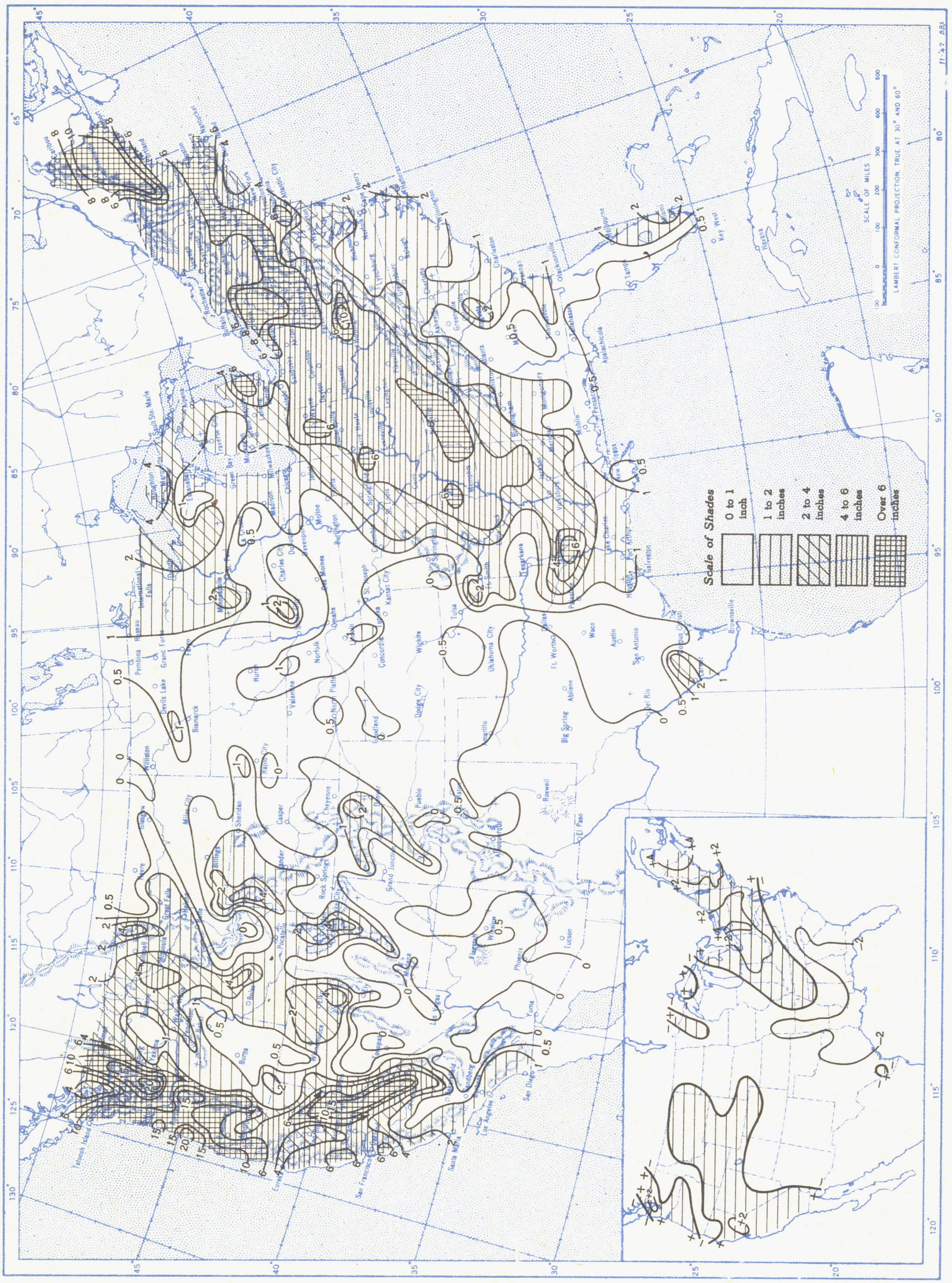


Chart V. Total Precipitation, Inches, November 1950. (Inset) Departure of Precipitation from Normal

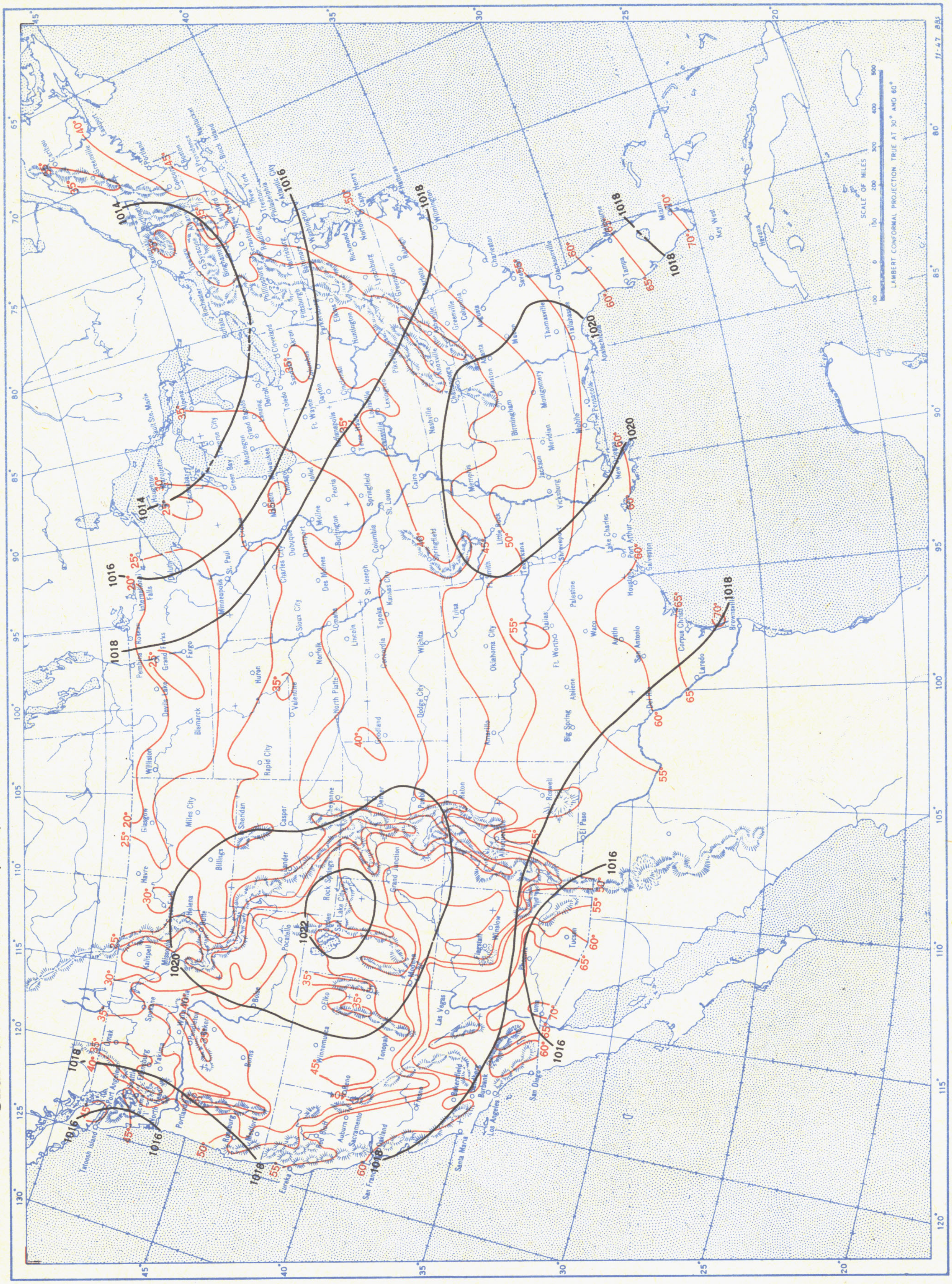


Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms (°F.) at Surface., November 1950

Chart VII. Total Snowfall, Inches, November 1950.

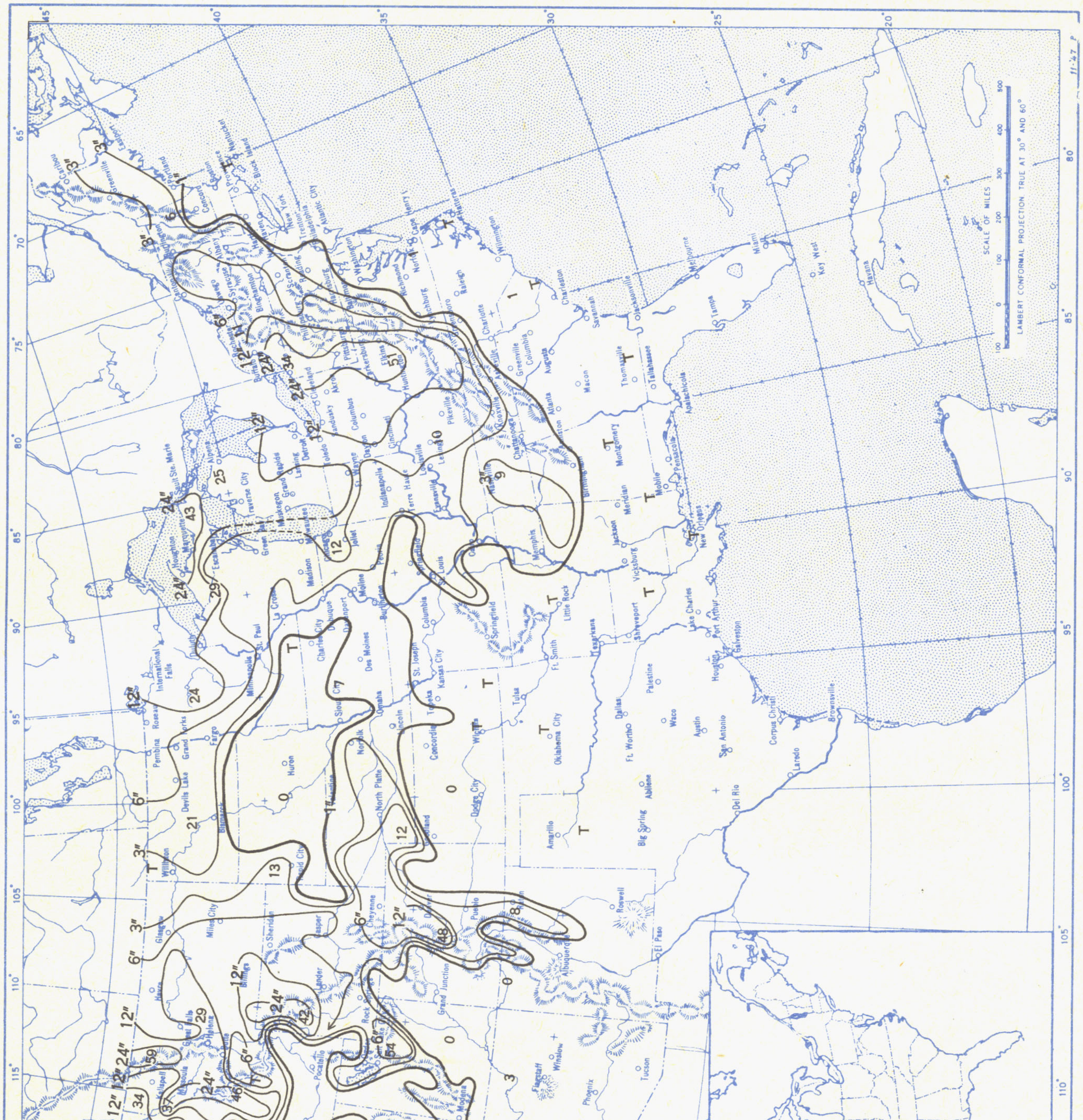
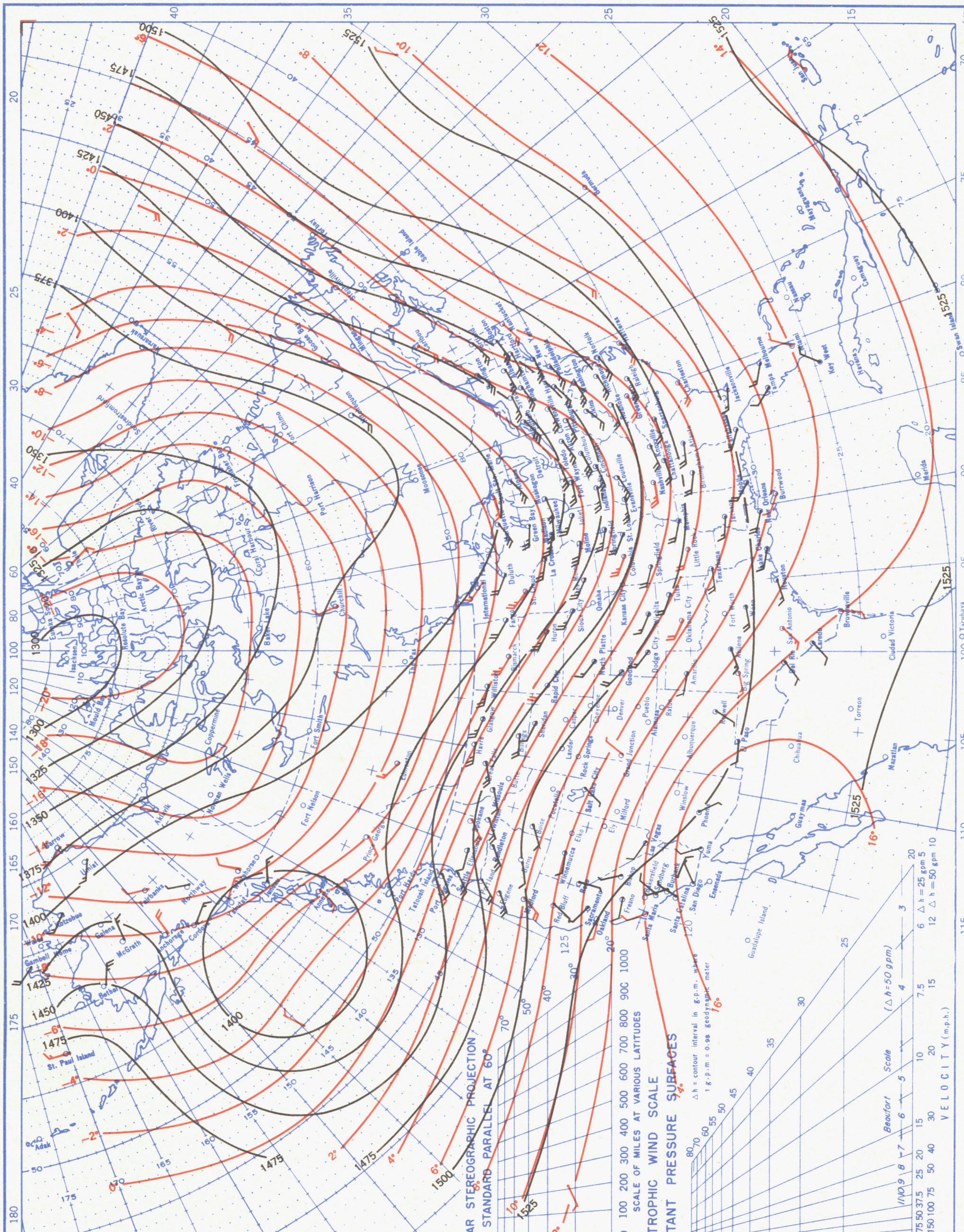
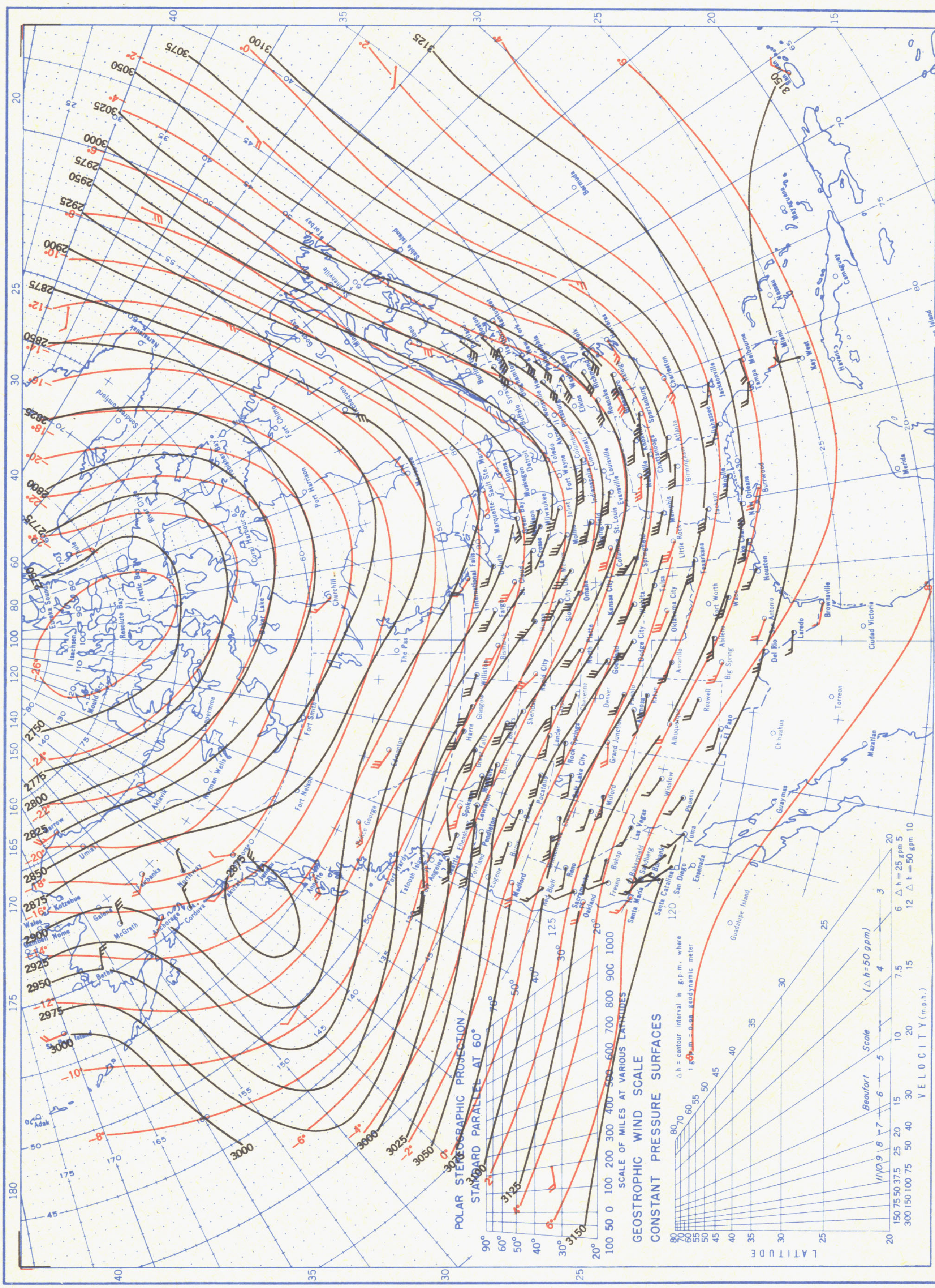


Chart VIII, November 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)



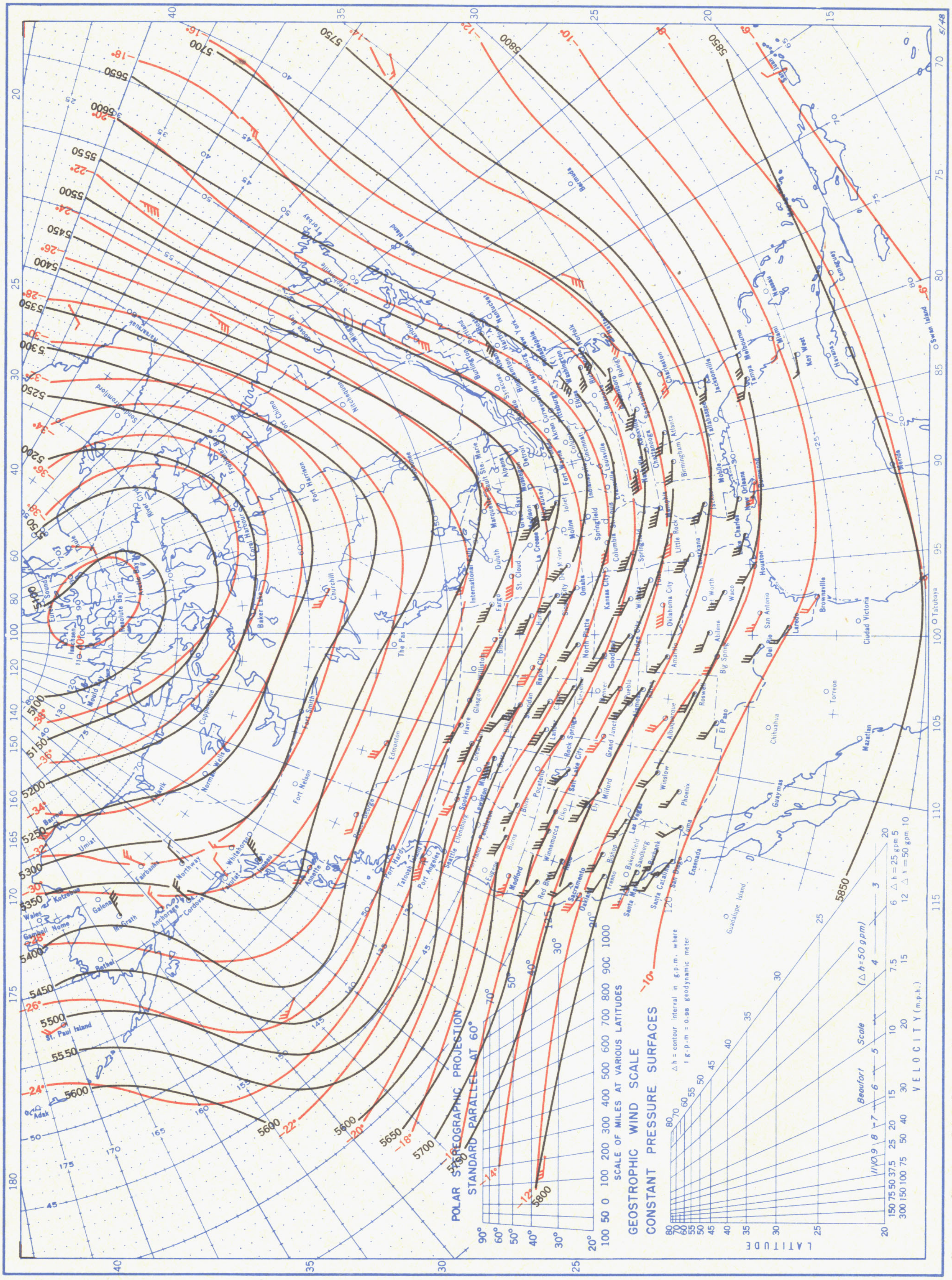
Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart IX, November 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)



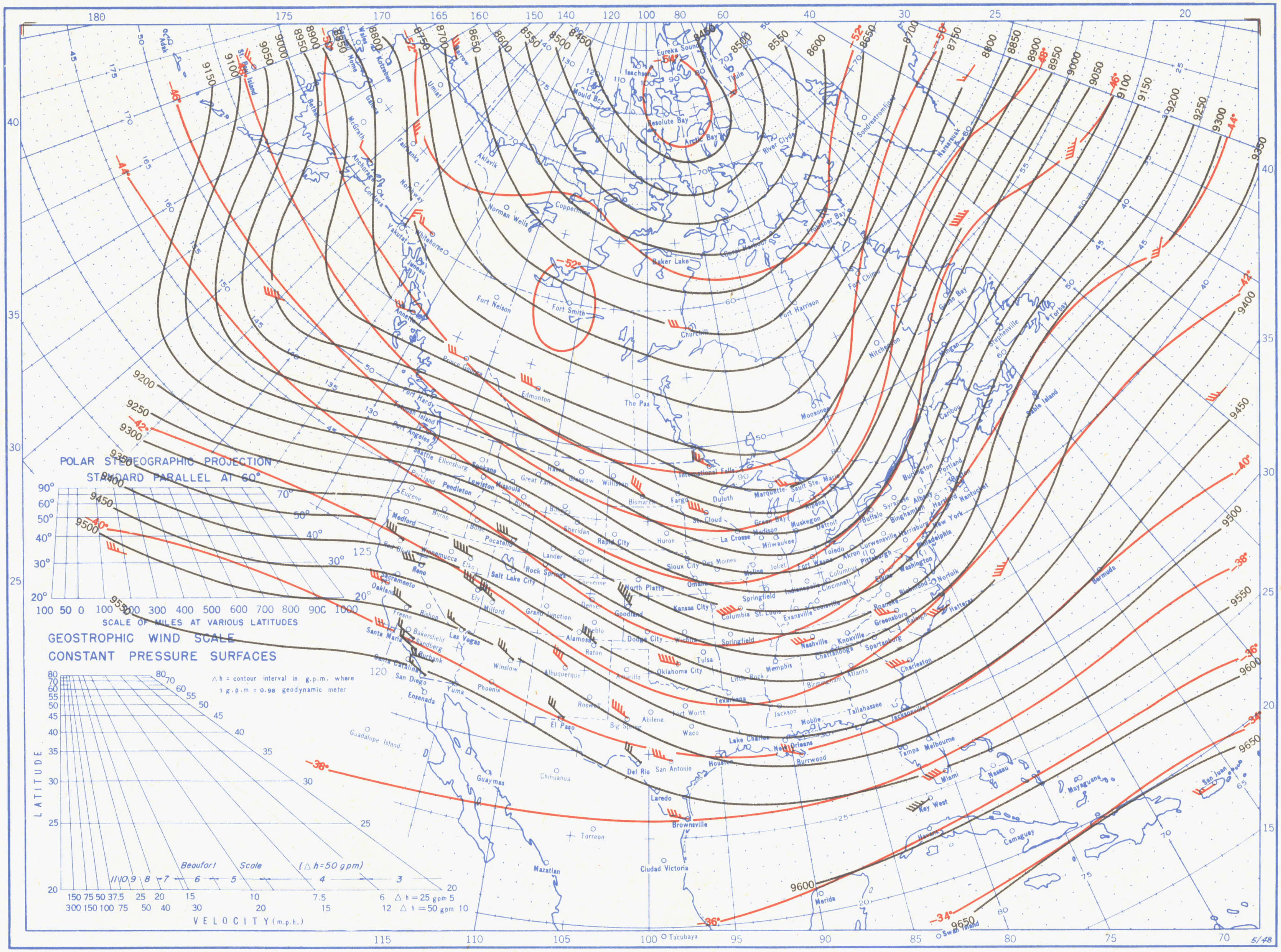
Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart X, November 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart XI, November 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.